

**TECHNICAL BRIEFING – 2013 ANNUAL MONITORING REPORT  
GROUP 1 SITES (PICA-079) – MAY 2014**

The document reviewed was an annual data report for the Group 1 Sites (PICA-079). The response action for the site included excavation and off-site disposal of explosive-impacted soils (600 cubic yards), implementation of LUCs, and monitored natural attenuation (MNA) of explosives in groundwater. The ROD for the site was signed in July and September 2010 by the Army and the USEPA, respectively. The sampling results contained in the annual report were completed in accordance with the Final Remedial Action Work Plan (2010). Sampling was performed in March, May, August, and November of 2013. Tasks included groundwater sampling, surface water sampling, and sediment sampling.

Group 1 Sites

There are four sites comprising Group 1 as follows:

- Site 40 – buildings were used for a washout facility and as a melt-pour facility. Explosives-contaminated wastewater was generated.
- Site 93 – used for sampling propellants, loading cluster bombs into warheads, and as a cleaning, inspection, and receiving facility of explosives.
- Site 156 – buildings were used as large caliber projectile loading plants and for inert storage.
- Site 157 – buildings were used for large caliber projectile loading plants. Also used for packing and shipping of completed rounds, and had a loading production line and melt-load facility for melted TNT and RDX.

The common factor to the four sites is that each site contains buildings that had been used in the manufacturing, testing, and “cleaning up” of explosives.

The annual monitoring report covers, groundwater, surface water, and sediment sampling to address the “comingled groundwater plume located beneath Sites 40 and 157.” Site 156 is covered by land use controls (LUCs) and addressed in the annual LUC certification report.

Contaminants of Concern (COCs)

The COCs consist of the following:

- 2-amino-4,6-dinitrotoluene (DNT);

- 4-amino-2,6-DNT;
- Cyclotrimethylenetrinitramine (RDX); and
- 2,4,6-Trinitrotoluene (TNT).

Table 1 summarizes the Site Cleanup Levels (SCLs) for the groundwater, surface water, and sediment.

#### Monitoring Program and Schedule

The MNA monitoring was implemented to: 1) evaluate long-term effectiveness of MNA; 2) verify that exposure to contaminants and their breakdown products did not cause additional risk; and 3) assess whether contingency actions would be required.

The schedule for sampling was quarterly for the first two years, then semiannually for the next three years, and then annually for the remaining remedy duration with any changes dictated at the time of five-year site-wide reviews. After the two years of quarterly sampling, the NJDEP requested sampling continue on a quarterly basis at five wells (40MW-1, 40MW-2, 40MW-3, 40MW-5, and 40MW-6) and at two surface water and sediment sampling locations (79SW/SD-1 and 79SW/SD-2) until the third quarter of 2015. Sample 79SW/SD-2 was added to the program at the request of the NJDEP in the second quarter of 2012.

#### SCLs and Comparison Criteria

There are no SCLs for surface water and sediment. Surface water data is screened against the New Jersey Surface Water Quality Standards. Sediment is compared to the surface soil SCLs.

#### Groundwater Monitoring

Wells sampled on a quarterly basis: 40MW-1, 40MW-2, 40MW-3, 40MW-5, and 40MW-6

Wells sampled on a semiannual basis: 157MW-1, 157MW-2, 157MW-3, 157MW-4, and 93MW-2

Prior to sample collection depth to groundwater measurements were collected. Field parameters including pH, temperature, dissolved oxygen, and oxidation-reduction potential were measured at the time of sampling.

### Surface Water and Sediment Monitoring

Both of the surface water and sediment locations (79SW/SD-1 and 79SW/SD-2) continue to be sampled on a quarterly basis.

### Data Validation

Limited validation was performed. No major deficiencies were identified.

### Groundwater Flow Conditions

Depth to groundwater measurements were converted to elevations and used in the preparation of a groundwater potentiometric map. Flow is to the northwest (away from Picatinny Lake). The report states the following in regard to groundwater flow direction: “However, typical groundwater elevations measured since 2010 indicate an easterly flow direction towards Picatinny Lake.” In response to an inquiry related to an explanation of the 180 degree reversal of flow direction ARCADIS provided the following reply:

“In general, groundwater flow is towards Picatinny Lake. However, several factors at PICA 79 affect what appear to be ‘flow reversals’.

1. Groundwater gradients beneath the site are extremely flat. For instance, Fig 2 depicts only 0.11 ft (1.32 inches) in elevation difference between 93MW-2 and 157MW-3 – a distance of approximately 300 ft.
2. The close proximity of the site to Picatinny lake and the site essentially being a peninsula, suggests that water levels at Picatinny lake can exert a considerable influence to the water levels observed beneath the site. Therefore, it is likely that minor variations in lake level, coupled with the extremely flat groundwater gradient, can affect observed groundwater elevations (i.e., a slight rise in lake levels may cause the appearance of flow reversals).
3. The apparent flow reversals (i.e., groundwater flowing away from Picatinny Lake) are a transient phenomena and the inherent limitation of periodic sampling underscore the difficulty in making definitive groundwater trend statements.

Hence, while the groundwater data collected suggest a minor groundwater flow away from Picatinny lake, review of overall groundwater data going back several years indicates an overall trend for groundwater flow towards the east (to Picatinny Lake). “

### Groundwater Monitoring Results

- 2-amino-4,6-DNT and 4-amino-2,6-DNT were not detected at concentrations exceeding the SCL (73 ug/L).
- The highest detection of 4-amino-2,6-DNT was 67.6 ug/L at Well 40MW-3 in the November 8, 2013 sampling.
- The next highest detections of 4-amino-2,6-DNT were in Well 40MW-2 where concentrations ranged from 41.7 to 54.8 ug/L in four quarters of sampling. Other reported results ranged from not detected to 26.3 ug/L (Well 40MW-5).
- The highest detection of 2-amino-4,6-DNT was 16.6 ug/L at Well 40MW-3 in the November 8, 2013 sampling. The next highest detection was 11.5 ug/L at Well 40MW-5 in the March 19, 2013 sampling. All other detections were less than 10 ug/L.
- RDX was detected at all wells except the upgradient monitoring well (93MW-2). Most detections exceeded the SCL (2 ug/L) with the highest detection occurring at 40MW-2 (194 ug/L) in the May 2013 sampling event.
- TNT exceeded the SCL (2 ug/L) at five wells (157MW-3, 40MW-1, 40MW-2, 40MW-3, and 40MW-6) with the highest detection (125 ug/L) at Well 40MW-2 in the August 2013 sampling event.

### Surface Water Monitoring Results

There is no established SCL for surface water. Results were compared to NJ Surface Water Quality Standards (SWQS) which are identical to groundwater SCLs for the four compounds. No COCs were detected above the NJ SWQS. With the exception of three detections for 2-amino-4,6-dinitrotoluene (0.342 J ug/L), 4-amino-2,6-dinitrotoluene (1.51 ug/L), and RDX (0.740 J ug/L) at 79SW-2, all the results were not detected.

### Sediment Results

There is no established SCL for sediment. Surface soil SCLs were used as the basis of comparison. All of the results for location 79SW-1 were not detected for all four sampling events. Location 79SD-2 was only sampled in three quarters (May, August, and November 2013). There were exceedances

detected in the May 2013 and November 2013 results. TNT was detected at 3,070 mg/kg at location 70SD-2; the result was 32 times the SCL of 95 mg/kg. The TNT result for the November 2013 sampling was even higher (7,930 mg/kg) - 83 times the SCL. RDX was also detected (1,090 mg/kg) above the SCL (26 mg/kg) in the November 2013 sampling.

The report text stated that Location 79SD-2 would be sampled on a quarterly basis but only three rounds of results were provided in the report. In response to an inquiry to ARCADIS the following explanation was provided:

“Sediment sampling at location SD-2 was originally schedule [sic] to be conducted semi-annually starting in year three (3<sup>rd</sup> quarter of 2012) of the LTM program. Samples were schedule [sic] for collection during the 2<sup>nd</sup> and 4<sup>th</sup> quarters of 2014. However, due to the 2<sup>nd</sup> qtr 2013 detection of explosives in sediment at this location, ARCADIS opted to collect an additional round of samples during 3<sup>rd</sup> quarter to confirm the sediment concentrations. Sampling resumed per the original schedule during 4<sup>th</sup> quarter 2013. Hence, why three quarters of samples are collected. Subsequently, during a Feb 2014 meeting, NJDEP requested that the Army resume quarterly sampling at this location and continue quarterly sampling until the next five year review. “

#### Data Trend Analysis

##### Site 40

While there are fluctuations of COC concentrations in a couple wells and still exceedances of the SCLs, it is noted that the concentrations are below the maximum detected concentrations. The remedy was deemed to be protective of human health and the environment.

##### Site 157

The concentrations in downgradient wells are attributed to fluctuations in concentrations in the upgradient well (157MW-6S) which has rebounded in concentrations of both TNT and RDX and to “inconsistent groundwater flow conditions.” Those flow conditions are considered to have been influenced by the nearby lake which was lowered at least twice for a dam improvement project. Concentrations of both RDX and TNT fluctuate in Well 157MW-3; RDX shows an overall decrease whereas TNT shows an increase. The rebound event is supposedly past peak. The remedy is deemed to be protective of human health and the environment.

Site 93

There is only a single well in the area and it is upgradient of the explosives plumes.

#### Remedy Going Forward

Groundwater concentrations in eight of the ten monitoring wells appear to show “an overall declining trend for RDX and/or TNT indicating that natural attenuation continues to reduce explosives concentrations.” Two wells (157MW-3 and 40MW-2) have fluctuating concentrations and concentrations that are many times the SCLs. The report states that those concentrations “are expected to decrease with time as constituent concentrations in surrounding wells have been declining.”

The time frames stated in the Record of Decision to achieve SCLs for the COCs are as follows:

- TNT at Site 40 – 11 years
- RDX at Site 40 – 9 years
- TNT at Site 157 – 8 years
- RDX at Site 157 – 8 years

The report states that a reevaluation of the pore flushing model, originally done as part of the Remedial Action Work Plan, was completed using peak concentrations of RDX and TNT observed since 2010. Those peak concentrations along with “current groundwater gradients indicate the remedial time frame may be closer to 30 to 40 years.” No details on the reevaluation are provided in the report. No indication of how the peak concentrations differ from those used previously nor of how the groundwater gradients differ from those originally used are provided. It is difficult to understand such a radical difference in time frames without further information.

In response to the statement regarding understanding the difference in time frames ARCADIS supplied the following additional information:

“The remedial time frame as presented within the Remedial Action Work Plan (RAWP) utilized a “Pore Flushing” model to estimate an initial cleanup timeframe. Two variables from the pore flushing model were utilized to revise an estimated cleanup timeframe: (1) the observed peak concentration of the contaminant, and (2) the groundwater gradients used to determine groundwater flow velocity. First, the 2013 reevaluation of the pore flushing model used a

higher peak contaminant concentration to reflect the current conditions observed during the 2011 to 2013 timeframe. Second, the 2013 recalculation utilized a lesser groundwater gradient. The following lists the specific differences between the original and recalculated pore flushing model:

Site 40 MNA Time Frame	Concentration (ppb)	Groundwater Gradient (ft/ft)
Original Calculation As Stated in ROD	TNT Site 40 = 109 RDX Site 40 = 88 TNT Site 157 = 32 TNT Site 157 = 33	.0027
Recalculation (using observed peak concentrations between 2011 and 2013)	TNT Site 40 = 523 RDX Site 40 = 490 TNT Site 157 = 251 RDX Site 157 = 202	0.0009 (based on current groundwater gradients)

Monitoring will continue in accordance with the current program. The next five year review occurs in 2016.

COC	Groundwater SCL ug/L	Surface Water LOC ug/L	Sediment LOC mg/kg
2-amino-4,6- dinitrotoluene (DNT)	73	73	2000
4-amino-2,6- DNT	73	73	1900
RDX	2	2	26
TNT	2	2.2	95

Table 1. Summary of Comparison Criteria.